Space Weather Technical Forecast

Issued on Thursday, 06 June 2024 at 12:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-flares

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low activity, but with frequent C-flares, peaking C9.5 at 06/0014 UTC. This occurred from a new region from around the southeast limb that is not yet visible. There are eight sunspot regions currently on the visible disc, however these are generally either small unipolar regions or simple bipolar groups. The main exception is AR3697, which has seen its recent simplifying trend stall, and persists as a small but relatively complex group, with a delta configuration. A small, and very weak delta spot also developed in AR3703 on the southwest disc, however this has remained stable.

There are no Earth-directed CMEs, with the three observed CMEs, including the filament eruption on 05 Jun, either missing or on the far-side.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, have been at background or near background levels throughout, ranging between 350-440 km/s. Density eased from around average to below average values. Interplanetary Magnetic Field (IMF), Bt, remained weak, at 7nT or below, with the north-south component varying weakly between +6 and -5nT, but perhaps favouring a negative (southward) direction. Phi angle was negative (toward the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 persisted at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels with the associated 24-hour fluence well below Active. Observed fluence at 06/0000 UTC was 1.54e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Periods of Moderate activity is likely with isolated M-flares and a slight chance of X-class flares. These most likely from AR3697, or perhaps new regions moving onto the Earth-facing disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. The next potential enhancement is likely to be from CH42/+, which could bring slightly elevated or possibly elevated wind speeds later on day 3 or perhaps more likely on day 4 (08-09 Jun), although this is low confidence. Overall, Quiet geomagnetic activity is expected, increasing to give a spell of Unsettled with Active intervals with any coronal hole fast wind onset.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background levels, with a slight chance of rising above the S1/Minor Radiation Storm threshold given any notable flares. High energy electron flux is forecast to persist at background levels, with the associated 24 hour fluence forecast to remain below the Active threshold.

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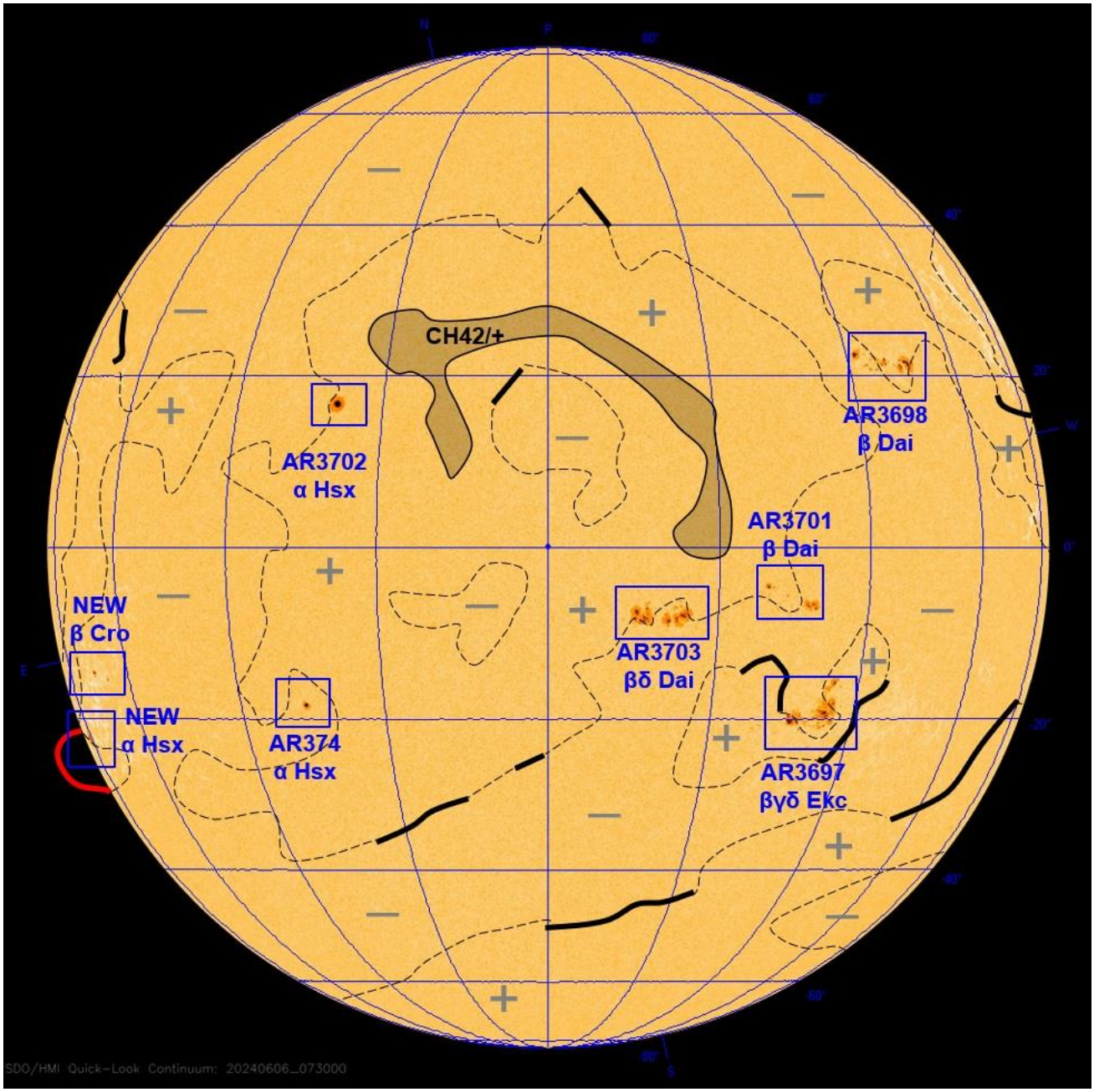
Figure 1. Solar Analysis Valid 06/0800 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

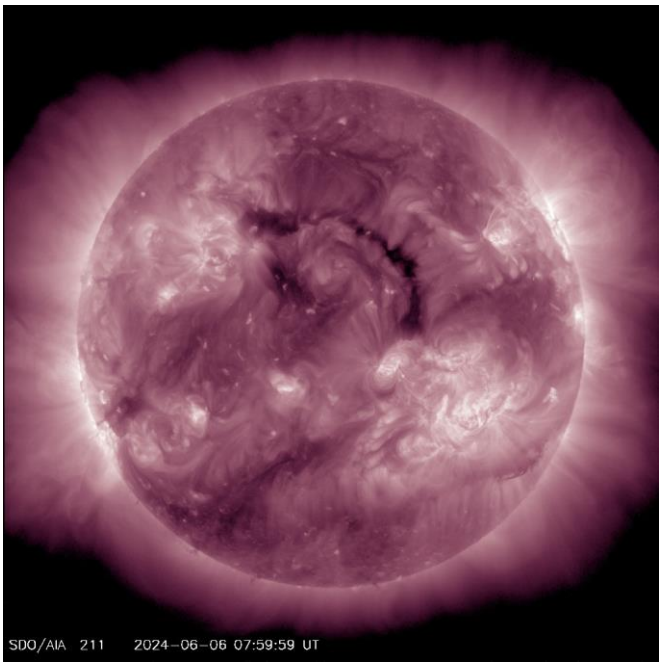
There are no Earth-directed CMEs.

Recent slightly elevated solar winds have now eased to background levels. The next potential enhancement is most likely to be from CH42/+ currently just west of the north-centre disc, which could bring slightly elevated or possibly elevated wind speeds later on day 3 or perhaps more likely on day 4 (08-09 Jun). This is low confidence, however, due to limited enhancement currently indicated in MOSWOC Enlil and the lack of evidence from the previous rotation, which was dominated by the arrival of fast CMEs. Any geomagnetic response is expected to be limited at this time of year, however (Russel-McPherron effect).

Overall, Quiet geomagnetic activity is most likely, but with potential for a spell of Unsettled to Active with a slight chance of G1/Minor Storms on Days 3-4 from any coronal hole fast wind onset.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SDO aia-211 showing narrow centre disc coronal hole.



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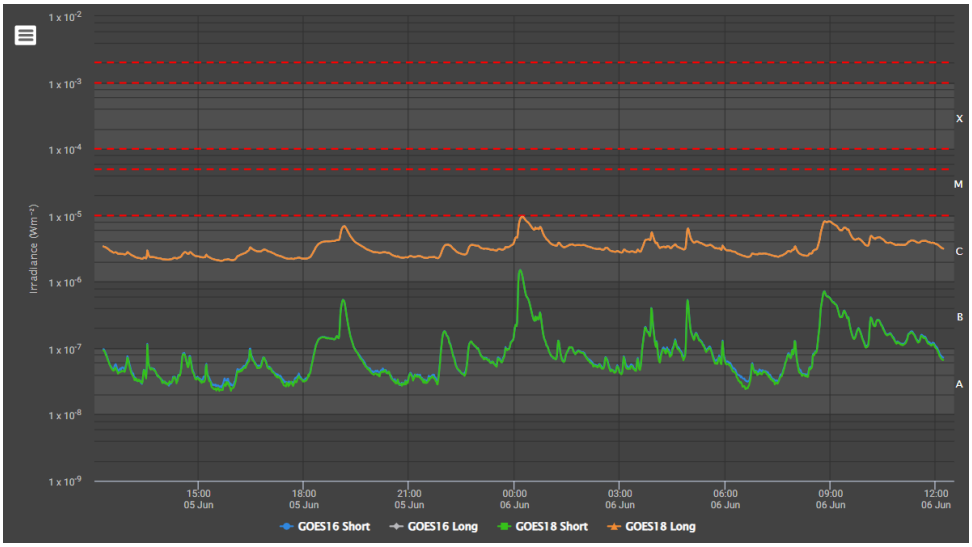
Radio Blackouts - X-Ray Flares:

Further periods of Moderate activity are likely with an ongoing chance of M-flares, primarily from AR3697 in the southwest or any new regions rotating onto the southeast disc. There is a slight chance of isolated X-class flares.

There are eight visible sunspot regions, with six currently numbered. AR3697 is now a relatively small to medium sized spot with only limited development occurring. The region consists of a negative penumbral area sandwich between two positive regions but maintains a delta configuration. This is accompanied with a complex magnetic structure above the spot evident in SDO imagery. AR3703 also has a very weak delta configuration, due to a very small negative umbra developing south of its trailer, however some consolidation of the intermediate regions into the main leader and trailer spots is ongoing. Small growth has also been observed in the intermediate spots of AR3698 in the northwest however this remains a simple bipolar region. There is also flux emergence on the southeast disc, with the development of a new spot and a further more mature region rotating onto the disc. Further regions have the potential to rotate onto the disc through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	70	70	60	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: GOES 16-18 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels. AR3697 is now much reduced compared to its previous active phase, but still contains the potential for further flares, albeit most likely at M-class. Alongside the other active regions, the majority of which are in the western disc, this gives a slight chance of proton flux exceeding the S1/Minor Radiation storm level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux, as observed by GOES-16, is expected to persist at mainly background levels, with no notable sources of potential enhancement currently anticipated. The associated 24 hour electron fluence is expected to remain well below the Active level. MOSWOC REFM is suggesting a slight increase in fluence later in the period, but this is currently thought to be unlikely to occur.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5:

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